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23 August 2016

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Abstract

Precision farming uses a system approach to provide a new solution to contemporary agriculture. In Tamil Nadu, precision farming was implemented under the Tamil Nadu Precision Farming Project (TNPFP) in Dharmapuri and Krishnagiri districts on about 400 ha from 2004-05 onwards. Most parts of the Krishnagiri district are semi-arid tracts with low rainfall and low productivity. In this context, there is a need for studying the impact of technological innovations like precision farming on resource-poor regions and underprivileged farm households. Specifically, the study has looked into the productivity, income and employment at farm level. Hence, Krishnagiri district was selected as the study area. As per the report of the government of Tamil Nadu, the number of precision farmers was high in Krishnagiri district. The study covered 168 precision farmers and 84 non precision farmers as the sample respondents to collect data. Thus the total size of the sample came to 252. The study found that the share of cost in the case of precision farmers was highest for human labour 27.17 per cent because to increase yield more labour required especially at the time of harvesting or cutting of the vegetables and flowers. Found that farmers used four types of fertilizer they are, straight fertilizer (urea, potash), farm yard manure (FYM - cow dung, poultry manure and vermin compost), bio-fertilizer (trichoderma) and water soluble fertilizer (19-19-19, Multi K) in the study area. Furhter observed that the FYM and bio- fertilizers involve high cost due to scarcity of cattle and awareness about the importance of FYM on soil quality.

***Key Words**: Precision Farming, Cost, Production, Fertilizers and Employment.*

Introduction

Traditional farming was very subsistence for our own requirement, after British arrival the crop cultivation changed into subsistence to commercial crops. The land tenure system and commercial crop cultivation severely affected Indians in the form of famine. India after independence was suffering from acute food shortage leading to import of food, largely under the Public Law 480 programme of the United States, although, our population was only a little over 300 million at that time. The landmark in the history of Indian Agriculture was in 1966, that, a new agricultural strategy was put into practice to tide over the chronic shortages of foodgrains and brink of famine in the country.[1] The Green Revolution has made our country self sufficient in food production. All this has been possible due to high input application, like increased fertilization, irrigation, pesticides, higher use of HYV's, increase in cropping intensity and increase in mechanization of agriculture.

During second post Green Revolution in India, growth rates in agriculture production and productivity were stagnating and profitability in farming diminished because the green revolution has not translated to the lower strata of the economic pyramid. Rather, it led to degrade the environment due to intensive use of agricultural inputs and lack of sustainability of its practices and achievement. Where population pressure was high, there was no option except to produce more food. Productivity must increase, but in ways which are environmentally safe, economically viable and socially sustainable[2]. In this contest, there is a need to convert this green revolution into an evergreen revolution, which will be triggered by farming systems approach that can help to produce more from the available land, water and labour resources, without harming ecological and the social structures. Precision farming is one which proposes to prescribe farm management practices which cater the needs of the present scenario in agricultural sector.

Precision Farming

Precision farming is an innovative, integrated and internationally standardized approach aiming to increase the efficiency of resource use and to reduce the uncertainty in farm management

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1 Kang, and Swaminathan , (2013), A Visionary, Barricade, November 2013, pp. 20-25.

2 Swaminathan M.S (2000) An Evergreen Revolution, Biologist, London, Vol. 7(2), pp. 85-89.

practices[3]. In fact that is an approach where inputs including water, seed, fertilizer, pesticide and labour applied in precise amounts to maximize the yield and minimize the inputs and sustainably increase average yield comparing to traditional method of cultivation. Hence, it is a judicious system of optimizing farm production by using key elements of information, technology and management so as to increase productivity and resource use efficiency such as improving quality of produce, less chemical use and conserve energy and environment to achieve the sustainable agricultural development. Precision farming which are extensively associated with water and fertilizer In other words, the right input at the right amount at the right place in the right time with the help of suitable technologies like Global Positioning System (GPS), Geographical Information System (GIS), Remote Sensing (RS) and Variable Rate of Technology (VRT) forms the crux of precision farming.

The best definition was that proposed by the US Congress that PA was integrated information and production based farming system that is designed to increase long term, site-specific and whole farm production efficiency, productivity and profitability while minimizing unintended impacts on wildlife and the environment.

National Research Council [1997][4] According to the council working definition of precision agriculture as a management strategy that uses information technology to bring data from multiple sources to bear on decisions associated with crop production. This increased, detailed historical information will be more commonly employed and relied upon for future needs and uses. The value of a vast amount of detailed historical information available through the use of precision agriculture technologies will change farmers operations, practices, marketing approaches, and management practices. **NRC, [1997][5]** it capturing the imagination of many people concerned with the production of food, feed and fiber. It offers the promise of increasing productivity, while decreasing production cost and minimizing the environmental impact of farming **[SKY-Farm, 1999][6]**.

[3] Schellberg et al. (2008), Precision agriculture on grass land: Applications, perspective and constraints, European Journal of Agronomy, Elsevier, Vol. 29, pp. 59-71.

[4] National Research Council (U.S.) (1997), Precision agriculture in the 21st century geospatial and information technologies in crop management, Library of Congress Cataloging-in-Publication Data, USA ISBN 0-309-05893-7, 1997.

[5] National Research Council (NRC) Precision Agriculture in the 21st century, National Academic Press, Washington DC, USA, Pp. 149.

[6] SKY Farm (1999), Opportunities of Precision Farming in Europe updated Report, 1999, Pp. 126.

Jose C. Samuel and H. P. Singh [2003][7] A holistic management strategy of precision farming involves the application of technologies and principles to manage spatial and temporal variability associated with all aspects of agricultural production for improving crop performance and environment quality. Precision farming calls for an efficient management of resources through location specific and hi tech interventions. The advance crop production strategy encompasses a variety of interventions such as micro irrigation, fertigation, protected greenhouse cultivation, soil and leaf nutrient-based fertilizer management, mulching moisture conservation, micro propagation, genetically modified crops, use of bio fertilizers, vermin culture, high-density planting, hi-tech mechanization, green food, soil less culture and biological control. Some of the other terminologies used for precision farming are Precision Agriculture (PA), Site-Specific Farming (SSF), Site-Specific Management (SSM), farming by the foot, and Variable Rate Technology (VRT). Utilization of these interventions orchestrated together having the aim of achieving higher output in given time period leads to precision farming, which is largely a knowledge driven.

Review of Past Empirical Studies

Daily et al., (1998)[8] stated that precision farming was it had recognized by environment sciences as an important part of solution towards sustainable agriculture and a way of maintaining intensive crop production, essential for food security in a growing world population under more restrictive environmental standards **(Matson et al., 1997)[9]**.

Haneklaus and Schnug (1998)[10] observed that precision agriculture is an umbrella terminology which embraces the knowledge and its practical expression which aims to solve the earlier presented contradiction uniformity applied on variability. Success, in this case, is not measured by how constant an operation is, but in how well it can react to varying conditions.

[7]Jose C. Samuel and H. P. Singh (2003), Perspective of Hi – Tech Horticulture and Precision Farming, Precision Farming in Horticulture, Pp No. 21 – 35.
[8] Daily et al., (1998), Food Production, Population Growth and the Environment Science, Pp. 281, 1291-1292.
[9] Matson et al.,(1997), Agricultural Intensification and Ecosystem Properties Science, Pp. 277, 504-509.
[10]Haneklaus et al., (1998), Impact of Precision Agriculture Technologies on fertilization. Proceedings of the 11th International Symposium of CIEC – Codes of good Fertilizer Practice and Balanced Fertilization, pp. 95-107.

Atherton, et al (1999) [11] **Olson, (1998)** [12] stated that the term precision agriculture describes the integration of GIS and GPS tools to provide an extensive amount of detailed information on crop growth, crop health, crop yield, water absorption, nutrient levels, topography, and soil variability.

Mueller et al., (2000) [13] expressed the enormous growth of advanced information technology, it includes describing variation in soils, plant species and integrating agricultural practices it is to meet site specific requirements. Precision farming aims at increasing economic returns whist at the same time reducing the energy input and the environmental impact of agriculture. This means, managing each crop production, input-fertilizer, lime, herbicide, insecticide, seed, etc. on a site-specific basis to reduce waste, increase profits, and maintain the quality of the environment.

Gerd Sparovek et al., (2001)[14] stated that agronomic science has provided knowledge expressed in terms of different practices and treatments, to manage the agro system over a wide range of condition, but uniformity is emphasized where most of this variability is expected the small scale. A plow is designed to operate at a uniform depth and produce in term result over a wide range of soil conditions and the farmer will be happy if, he can count exactly the number of planted seeds from the beginning to the end of his planting day.

Shibusawa (2002)[15] pointed out that precision farming uses a system approach to provide a new solution to contemporary agricultural issues, that is, the need to balance productivity with environmental concerns.

Samuel and Singh (2003)[16] stated that precision farming has attracted the attention of developed countries for increasing productivity by temporal and spatial management of resources using various tools. The concept of precision farming is new to the country and needs

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[11] Atherton B. C et al., (1999), Site-specific farming: A perspective on information needs, benefits, and limitations, Journal of Soil and Water Conservation, 54(2), Pp: 455-461.
[12] Olson, K. (1998), Sixth Joint Conference Food, Agriculture, and the Environment: Center for International Food and Agricultural Policy, University of Minnesota.
[13] Mueller et al.,(2000), Precision agriculture opportunities for Kentucky: Agronomic research at UK University of Kentucky, Department of Agronomy Research Report.
[14]GerdSparovek et al., (2001), Soil Tillage and Precision Agriculture A Theoretical case study for Soil Erosion control in Brazilian Sugarcane Production, Elsevier, Soil & Tillage Research, Vol. 61, pp. 47-54
[15] Shibusawa, S. (2002), Precision farming approaches to small-farm agriculture, Agro-Chemicals Report, Vol. II, No. 4.
[16]Jose C. Samuel and H.P. Singh, (2003), Perspective Of Hi-Tech Horticulture And Precision Farming, Precision Farming in Horticulture, Pp. 21 – 34.

appropriate attention for efficient utilization of resources to achieve higher input-use efficiency in given time. Suggested that in order to optimize the use of resources and improve the returns to the farmers, these technologies have to be adopted. Any component of production system ranging from natural resources to plants, production inputs, farm machinery and farm operators that is variable in some way is included in the realm of precision farming.

Pianaki Mondal et al., (2007)[17] in a comprehensive study stated that precision farming concept is spreading rapidly in developed countries as a tool to fight the challenge of agricultural sustainability. With the progress and application of information technology in agriculture, PF has been increasingly gained attentions worldwide.

AashishVelkar (2008)[18] found that technologies travelled from Tamil Nadu Agricultural University (TNAU) to the farming community. The associated technologies such as field preparation, plant protection, hybrid seeds and post harvest practices were also travelled well between TNAU and the beneficiary farmers.

Peter Howlett & Aashish Velkar(2008)[19] observed that the the physical technology of drip irrigation and fertigation tank, which were new to most farmers in the scheme, travelled extremely well to the beneficiary farmers. No evidence or statement, from either beneficiary or non-beneficiary farmers, of a farmer abandoning the drip irrigation and fertigation tank. The reason for this was not however the technology itself or the facts embodied in it, the reason was money. In this case the subsidy ensured successful travel. Indeed, it seems subsidy was a necessary condition of travel there was a lot of prior knowledge about the benefits of precision farming but farmers were still unwilling or unable to invest in drip irrigation and or fertigation tanks.

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[17]PinakiMondel et al., (2007), Present Status of Precision Farming: A Review, International Journal of Agricultural Research, Vol. 2 (1), Pp. 1-10.

[18]AashishVelkar,(2008), Tamil Nadu Precision Farming Project: An Evaluation, Department of Economics History, London School of Economics, Houghton Street, London WC2A2AE, Pp. 1 – 23.

[19]Peter Howlett&AashishVelkar, (2008), Agri-Technologies and Travelling Facts: Case Study of Extension Education in Tamil Nadu, India, November, Working Papers on The Nature of Evidence: How Well Do ‘Facts’ Travel?, Economic History Working Papers from London School of Economics and Political Science, Department of Economic History No. 35/08

Maheswari et al., (2008)[20] study pointed out that PA aims at increasing productivity, decreasing production costs and minimizing the environmental impact of farming. The study found that adoption of precision farming has led to 80 percent increase in yield in tomato and 34 per cent in brinjal production. Increase in gross margin has been found as 165 and 67 percent, respectively in tomato and brinjal farming. The contribution of technology for higher yield in precision farming has been 33.71 per cent and 20.48 per cent respectively in tomato and brinjal production.

Liaghat and Balasundram (2010)[21] stated that the precision agriculture is an emerging farm management strategy that is changing the way people farm.

Antoni et al., (2012)[22] pointed out that the precision agriculture technology overall, profitable investments for farmers, as previous literature has established It was found to be significant and positively related to the perceived future importance of precision agriculture as well as farmers' ranking of input cost savings relative to other attributes of the GPS technology.

Researchable Issues

Precision farming uses a system approach to provide a new solution to contemporary agriculture[23]. In Tamil Nadu, precision farming was implemented under the Tamil Nadu Precision Farming Project (TNPFP) in the Dharmapuri and Krishnagiri districts on about 400 ha from 2004-05 onwards. Most parts of the Krishnagiri district are semi-arid tracts with low rainfall and low productivity. In this context, there is a need for studying the impact of technological innovations like precision farming on resource-poor regions and underprivileged farm households. Specifically, the study has looked into the productivity, income, employment, and adoption behavior of the technology in agriculture at farm level.

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[20]R. Maheswari et al., (2008), Precision farming technology, adoption decisions and productivity of vegetables in resource-poor environments, Agricultural Economics Research Review, vol. 21.

[21] Liaghat, S. and S.K. Balasundram., (2010), A Review: The Role of Remote Sensing in Precision Agriculture, American Journal of Agriculture, Biological Science, Vol. 5, pp.50-55.

[22] Jeremy M. D'Antoni et al., (2012), Farmers' perception of precision technology: The case of autosteer adoption by cotton farmers, Computers and Electronics in Agriculture, Vol. 87, September, pp. 121-128.

[23] Shibusawa (2002), Precision farming approaches to small-farm agriculture. Agro-Chemicals Report Vol. II (4)

Objectives of the Study

1. To study socio-economic characteristics of the selected farmers,
2. To study the source of information and cost of cultivation under precision and non – precision farming.

Hypotheses

1. There is no significant relationship between education and income, and
2. There is no significant difference between precision and conventional farming in the level of farm income.

Methodology

The present study is based on primary data. The data has been collected from farmers who adopt precision and non precision farming. Multi stage simple random sampling technique was used to collect the data with using well structured interview schedule. In the first stage, the district was identified on the basis of the Tamil Nadu Precision Farming Project (TNPFP) implementation. According to the report of the government of Tamil Nadu the number of precision farmers was high in Krishnagiri district among the other districts of Tamil Nadu. In second stage Hosur, Kelamangalam and Tally three blocks have been identified on the basis of high number of beneficiaries which was 840 farmers in the year 2012-13. At the final stage 168 precision farmers and 84 non precision farmers have been considered, thus, the total sample came to 252. The data, thus collected, were analysed by using simple statistical tools such as, percentage, average, correlation and ANOVA

Results and Discussion

The focus of the study is to analyse the nature of the method of precision farming adopted at farm level by comparing farmers comes under precision methods and conventional methods in the selected area of Krishnagiri district, Tamil Nadu. The empirical evidences attained from the statistical analysis presented and discussed below to get a comprehensive understanding on the adoption of precision agriculture, farm productivity, employment structure, reduced use of chemical fertilizers and pesticides use of bio-fertilizers and farm yard manures to enhance productivity and soil quality, adoption of drip irrigation methods and fertigation in selected areas of Krishnagiri district of Tamil Nadu.

A field study was conducted to collect the data pertaining to the need of revamping and rejuvenating agriculture to convert the farm into lucrative one.

Table 1. Details of Classification of the Sample Respondents Based on Sex, Age and Educational Qualification

Sl. No	Particulars		Precision Farming	Conventional Farming	Grand Total	Percentage
(1)	**(2)**		**(3)**	**(4)**	**(5)**	**(6)**
1	Sex	Male	162	84	246	97.62
2		Female	6	-	6	2.38
3		**Total**	**168**	**84**	**252**	**100**
4	Age	>25 Years	15	06	21	8.33
5		26 – 50	106	37	143	56.73
6		51 & Above	47	41	88	34.92
7		**Total**	**168**	**84**	**252**	**100**
8	Education	Illiterate	16	23	39	15.47
9		Primary	48	36	84	33.33
10		High School	67	15	82	32.53
11		Degree	32	00	32	12.69
12		Others	13	02	15	05.95
		Total	**168**	**84**	**252**	**100**

Source: Primary Data

The classification of farmers based on sex, age and educational qualification are presented in table 1. Out of 252 numbers sample size 246 respondents were (97.62%) belongs to male farmers and 6 respondents (2.38 %) belongs to female farmers. 21 respondents (8.33%) belongs to the age group of below 25 years, 143 respondents(56.73%) belongs to the age group between 26 – 50 and 88 respondents (34.92 %) belongs to the age group above 51 years. While looking into the literacy level (39 %) of the respondents are illiterates, (33.33%) are coming into the category of primary education, (32.53 %) belongs to high school level of education, (12.69 %) comes under the college level of education and only (5.95 %) belongs to the others category such as ITI and Diploma. Thus the following were the overall observations made from above table.

1. Majority that is 97.2 % of the farmers were male.
2. 56.73 % of the respondents were belongs to 26 – 50 age group.
3. About 85 % of the respondent farmers were literates.

Table 2 Details of Sample Respondents Based on Marital Status, Nature of Family and Family Size

Sl. No	Particulars		Precision Farming	Conventional Farming	Grand Total	Percentage
(1)	**(2)**		**(3)**	**(4)**	**(5)**	**(6)**
1	Marital Status	Married	124	78	202	80.15
2		Unmarried	44	6	50	19.84
3		**Total**	**168**	**84**	**252**	**100**
4	Nature of Family	Joint	64	24	88	34.92
5		Nuclear	104	60	164	65.07
6		**Total**	**168**	**84**	**252**	**100**
7	Family Size	>4 members	52	22	74	29.36
8		5 – 6	73	38	111	44.04
9		7 & Above	43	24	67	26.58
10		**Total**	**164**	**84**	**252**	**100**

Source: Primary Data

As observed in table 2, out of a total of 252 sample respondents 202 respondents (80.15%) were married, 50 respondents (19.84%) were unmarried farmers. While looking into the nature of family (34.92%) of the respondents are joint family and the remaining (65.07 %) were living as nuclear family. Under the category of size of the family 29.36 per cent of the respondents are belongs to below 4 members, 44.04 per cent of the respondents are belongs to between 5 – 6 members and 26.58 per cent of the respondents are belongs to 7 and above members of family size. The above discussion thus reveals that

1. Around 80 % of the farmers married.
2. About 65 % of the farmers were living in as nuclear family
3. Majority that is 44.04 % of the respondents had 5 – 6 members at an average.

Table 3 Details of Sample Respondents Based on Land Holdings, Source of Irrigation and Social Status

Sl. No	Particulars		Precision Farming	Conventional Farming	Grand Total	Percentage
(1)	**(2)**		**(3)**	**(4)**	**(5)**	**(6)**
1	Land Holdings	Marginal	15	32	47	18.65
2		Small	38	34	72	28.57
3		Medium	68	11	79	31.34
4		Large	47	07	54	21.42
5		**Total**	**168**	**84**	**252**	**100**
6		Own land	167	72	239	94.84
7		Leased Land	1	12	13	5.15
8		**Total**	**168**	**84**	**252**	**100**
9	Irrigation	Electric Bore	126	24	150	59.52
10		Dripper Tank	29	-	29	11.50
11		River/Dam	13	28	41	16.26
12		Rain Fed	-	32	32	12.69
13		**Total**	**168**	**84**	**252**	**100**
14	Social status	SC	05	18	23	9.12
15		BC	78	43	121	48.01
16		OC	85	23	108	42.85
17		**Total**	**168**	**84**	**252**	**100**

Source: Primary Data

Table 3 shows the details of the land holding, source of water and social status. Among the 252 respondents only 18.65 per cent belongs to marginal farmers, 28.57 per cent belongs to small farmers, 31.34 per cent belong to medium farmers and 21.42per cent belongs to the large farmer category. 94.84 per cent respondents farmer possessing own land and 05.15 per cent of the respondents farmers possessing leased land. While looking into source of water 59.52 per cent of the respondents belongs to electric bore irrigation, 11.50 per cent of the respondents dripper tank irrigation, 16.26 per cent of the respondents depends to River and dam for source of irrigation and 12.69 per cent of the respondents fall under the rain fed source of irrigation. Regarding social status 09.12 per cent comes under SC/ST category, 48.01 per cent comes under BC category and 42.85 per cent comes under forward community category.

As observed that about 95 % of the respondent farmers had own land and 59.52 % of the respondents were using electric bore for irrigation specifically those who adopt drip irrigation.

Table 4 Details of Classification of the Respondents Based on Source of Information

Sl. No	**Particulars**	**Precision Farming**	**Percentage**	**Conventional Farming**	**Percentage**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	TNAU	34	20.23	-	-
2	Dept. of. Horticulture	23	13.69	-	-
3	Krishi Vigyan Kendra	5	02.98	-	-
6	Other Progressive farmers	57	33.93	-	-
7	Farmers Tour	8	04.76	-	-
8	Agro Dealer	35	20.83	24	28.57
9	Other Source	6	03.57	-	-
10	Own Practice	-	-	60	71.42
	Total	**168**	**100**	**84**	**100**

Source: Primary Data

Source of information about precision agriculture is given in Table 4. Out of 168 precision farmers 57 respondents (33.93 %) received information from other progressive farmers. Followed by about 20 % of the respondents had received information from TNAU and local agro input dealer. 13.69 per cent of the respondents had received information from department of horticulture. 02.98 per cent of the respondents had received information from KVK. 4.76 per cent of the respondents visited farmers tour to Karnataka Agricultural University and areas, 03.57 per cent of the respondents had received information from other sources. Out of 84 conventional farmer 28.57 per cent of the respondents has received information from input dealers and 71.42 per cent of the respondent has own practice without any one source of information.

The source of information about precision agriculture was neighbor progressive farmer, TNAU and local agro input dealers with the following percentage share progressive farmers 33.93 % agro input dealers 20.83 % and TNAU 20.23 % respectively.

Table 5 Details of Cost of Cultivation of Precision and Conventional Farming per Acre

SI. No	Particulars	Conventional Farming	Precision Farming	Percentage in Difference (Col.(3) – Col.(4) / Col.(4) X 100)
1	Field Preparation	5,250 (8.71)	6,500 (5.91)	-19.23
2	Drip System	-	20,000	100.00
3	Nursery and Planting	5,000 (8.29)	7,000 (6.37)	-28.57
4	Weeding	9,500 (15.76)	7,500 (6.82)	23.52
5	Plant Protection	12,500 (16.59)	8,500 (7.73)	47.05
6	Fertiliser	9,500 (15.76)	21,000 (19.11)	-54.76
7	Farm Yard Manure	5,000 (8.29)	10,000 (9.10)	50.00
8	Wage	16,500 (27.38)	29850 (27.17)	-44.72
	Total	60,250 (100)	1,09,850 (100)	-45.15

Source: Primary Data

Economics of crop production were estimated for precision and conventional methods of cultivation the details are presented in the table 5. The share of cost in the case of precision farmers was highest for human labour 27.17per cent, followed fertilizer 19.11per cent and farm yard manure (FYM) is 9.10 per cent. Within the cost of human labour 65.51 per cent was paid out to hired labour majority of them female labour and rest of imputed value of family labour. In conventional farming, human labour was found to be the major input, accounting 27.38 per cent followed by plant protection chemical 16.59 per cent, fertilizer 15.76 per cent, nursery and planting and farm yard manure (FYM) constitute 8.29 per cent each respectively.

Table 6 Results of Correlation Co-efficient

Sl. No	Variables	r. Value
(1)	**(2)**	**(3)**
1	Education and Income	0.334**
2	Expenditure and Income	0.704**
3	Cost and Revenue	0.634**
4	Income and Family Size	-0.520**

**. Correlation is significant at the 0.01 level (2-tailed).

1. Hypothesis (Ho)

There is no significant relationship between education and income.

Correlation results for education and Income revealed that there is significant relationship between education and income and it is also statistically significant at 1 percent level the r. value 0.334. Hence null hypothesis was rejected and alternative hypothesis was accepted that is., There is significant relationship between education and income.

2. Hypothesis (Ho)

There is no significant relationship between and income expenditure

Correlation results for expenditure and income revealed that there is significant relationship between Expenditure and Income and it is also statistically significant at 1 percent level the r. value 0.704. Hence null hypothesis was rejected and alternative hypothesis was accepted that is., There is significant relationship between Expenditure and Income.

3. Hypothesis (Ho)

There is no significant relationship between cost and revenue.

Correlation Results for Cost and Revenue are given table 6. The table revealed that there is significant relationship between Cost and Revenue and it is also statistically significant at 1 percent level the r. value 0.634. Hence null hypothesis was rejected and alternative hypothesis was accepted that is., There is significant relationship between Cost and Revenue.

4. Hypothesis (Ho)

There is no significant relationship between family size and income.

Correlation results for income and family size revealed that there is significant relationship between Income and family Size and it is also statistically significant at 1 percent level r. value -0.520. Hence null hypothesis was rejected and alternative hypothesis was accepted that is., There is significant relationship between Income and family Size.

Table 7 Details of ANOVA Result for Revenue of Precision and Conventional Farming

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.778	2	8.8920	3276.52	0.033
Within Groups	4.223	249	1.6961	-	-
Total	4.241	251	-	-	-

Note: * Represents the level of significance at 5 Per cent level.

ANOVA result for Revenue of precision and conventional farming is presented table 7. The estimated F statistics was 3276.52 which were significant at 5 percent level. Hence the null hypothesis was rejected and alternative hypothesis was accepted that is., there is a significant difference between revenue of precision and conventional farming.

Hypothesis (H0)

There is no significance difference between Cost of precision and conventional farming.

Table 8 Details of ANOVA Result for Cost of Precision and Conventional Farmer

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.17212	2	1.5812	4056.896	0.001
Within Groups	3.05414	249	1.2212	-	-
Total	3.08614	251	-	-	-

Note: * Represents the level of significance at 1 Per cent level.

ANOVA result for Cost of precision and conventional farmer is presented table. The estimated F statistics was 4056.896 which were significant at 1percent level. Hence the null hypothesis was rejected and alternative hypothesis was accepted that is., there is a significant difference between revenue of precision and conventional farming.

Findings of the study

Socio Demographic Characteristics

- It was noted that majority of the respondents i.e., 56.73 per cent were belongs to 26 – 50 age group
- Found that about 85 per cent of the respondent farmers were literates.
- The study revealed majority that is 44.04 per cent of the respondents had 5 – 6 members at an average in their family.

Economic Factors

- The study found that about 31.34 per cent belongs to medium farmers.
- The study observed that about 95 per cent of the respondent farmers had own land and 59. 52 per cent of the respondents were using electric bore for irrigation specifically those who adopt drip irrigation.

Farming Factors

- Found that the share of cost in the case of precision farmers was highest for human labour 27.17 per cent. Which is mainly due to increasing yield of the crop may lead more labourers need at the time of harvesting or cutting of the vegetables and flowers.
- There was a new type of irrigation method has taken place in the study area that, where ever the ground water level was totally abandoned the farmers buying water for crop cultivation through the tractor water dripper costing Rs. 400 to 600 per dripper. Majority of the crop cultivated under irrigation was high value crop such as capsicum and rose.
- Found out that farmers use four types of fertilizer they are, straight fertilizer (urea, potash), farm yard manure (cow dung, poultry manure and vermin compost), bio-fertilizer (trichoderma) and water soluble fertilizer (19-19-19, Multi K). The FYM and bio- fertilizer cost recently increasing due to scarcity of cattle and awareness about the importance of FYM on soil quality. The high price of WSF and scarcity of FYM is led to deviated farmers to use straight fertilizers on their farm. However, farmers are opinioned that the composition of NPK with FYM only registered highest yield and maintain soil fertility.

- It was revealed that labour scarcity has taken places and labourers give preference to work MGNREGA 100 days employment programme at the wage of Rs. 120. The farmers were of the opinion that the labour force may be channelized to use for cultivation purpose under the same scheme in the form of Public Private Participation (PPP), thus the labour force may be used for productive purpose.

Conclusion

The study found that the share of cost in the case of precision farmers was highest for human labour 27.17 per cent because to increase yield more labour required especially at the time of harvesting or cutting of the vegetables and flowers. Found that farmers used four types of fertilizer they are, straight fertilizer (urea, potash), farm yard manure (FYM - cow dung, poultry manure and vermin compost), bio-fertilizer (trichoderma) and water soluble fertilizer (19-19-19, Multi K) in the study area. Furhter observed that the FYM and bio- fertilizers involve high cost due to scarcity of cattle and awareness about the importance of FYM on soil quality.

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